

## Claims

What is claimed is:

1. A winder for winding a web to produce a rolled product comprising:  
a web transport apparatus for conveying a web; and  
a plurality of independent winding modules that are independently positioned  
to independently engage the web as the web is conveyed by the web transport  
apparatus, the winding modules configured to engage the web and wind the web to  
form a rolled product by center winding, surface winding, or combinations of center  
and surface winding, the winding modules being structurally and operationally  
independent of one another wherein if one winding module is disabled another  
winding module can still operate to produce the rolled product without shutting down  
the winder.
2. The winder as set forth in claim 1, wherein the plurality of independent  
winding modules each have a driven mandrel onto which the web is wound to form  
the rolled product.
3. The winder as set forth in claim 1, wherein the plurality of independent  
winding modules each have a brake controlled mandrel onto which the web is wound  
to form the rolled product.
4. The winder as set forth in claim 2, wherein the mandrel is movably positioned  
so that the distance between the winding modules and the web transport apparatus  
is varied so as to produce a nip having a nip pressure, the web is wound into a rolled  
product by a combination of mandrel rotational speed, web surface speed, incoming  
web tension, and the nip pressure.

5. The winder as set forth in claim 4, wherein the web transport apparatus is a vacuum conveyor.
6. The winder as set forth in claim 1, wherein the web transport apparatus is a vacuum roll.
7. The winder as set forth in claim 1, wherein the web transport apparatus is an electrostatic belt.
8. The winder as set forth in claim 1, wherein the plurality of independent winding modules each have a core loading apparatus and a product stripping apparatus.
9. The winder as set forth in claim 2, wherein the mandrel is vacuum supplied for winding the web to form a coreless rolled product.
10. The winder as set forth in claim 2, wherein the mandrel is constructed of a carbon fiber composite.
11. The winder as set forth in claim 1, wherein the plurality of independent winding modules each have a tail sealing apparatus for adhering the tailing end of the web onto the rolled product.
12. The winder as set forth in claim 1, wherein adhesive is applied to the web prior to engagement by the winding module.

13. The winder as set forth in claim 1, wherein the web transport apparatus is a vacuum conveyor.

14. The winder as set forth in claim 1, further comprising at least one air blast for redirecting the web onto the winding module.

15. The winder as set forth in claim 1, further comprising a waste removal apparatus for removing lengths or pieces of the unwound web.

16. The winder as set forth in claim 1, wherein the winding is affected by controlling tension on the web.

17. The winder as set forth in claim 1, wherein the winding is affected by controlling torque of the winding modules.

18. The winder as set forth in claim 1, further comprising a core engaging the mandrel of each winding module, the web is wound onto the core and the web is attached to the core by adhesion.

19. The winder as set forth in claim 1, wherein the rolled product that is formed is solid and coreless and without a cavity.

20. The winder as set forth in claim 1, wherein the rolled product that is formed has a core.

21. The winder as set forth in claim 1, wherein the rolled product that is formed is coreless and has a cylindrical cavity in the center.

22. The winder as set forth in claim 1, wherein the plurality of independent winding modules are located in a substantially linear arrangement with respect to one another.
23. The winder as set forth in claim 1, wherein the plurality of independent winding modules are located in a substantially radial arrangement with respect to one another.
24. The winder as set forth in claim 1, wherein at least one of the plurality of independent winding modules is located in a different plane.
25. The winder as set forth in claim 1, wherein the plurality of independent winding modules are configured for winding a slit web.
26. The winder as set forth in claim 1, wherein the plurality of independent winding modules are positioned at the end of a tissue machine.
27. The winder as set forth in claim 1, wherein the plurality of independent winding modules wind the web directly from a paper making machine.
28. The winder as set forth in claim 1, wherein the plurality of independent winding modules are configured for producing rolled product having different sheet counts.
29. The winder as set forth in claim 2, wherein the plurality of independent winding modules each have a product stripping apparatus that supports, stabilizes, and properly positions the mandrel in preparation for, and during, core loading.

30. The winder as set forth in claim 1, wherein the plurality of independent winding modules each have a core loading and product stripping apparatus.

31. A method of producing a rolled product from a web comprising the steps of:  
conveying the web by a web transport apparatus;

winding the web into the rolled product by using a plurality of winding modules wherein only one winding module of the plurality of winding modules winds the web into the rolled product at any given time by a process selected from the group of center winding, surface winding, and combinations of center and surface winding, the winding modules acting independently of one another wherein if one or more winding modules are disabled the remaining winding modules can still wind the web to produce the rolled product without shutting down the plurality of winding modules; and

transporting the rolled product from the winding module.

32. The method as set forth in claim 31, further comprising the step of providing a slit web to be wound by the plurality of independent winding modules.

33. The method as set forth in claim 31, wherein the winding modules each have a mandrel and further comprising the steps of:

loading a core on the mandrel;

accelerating the mandrel to a desired rotation speed;

positioning the winding module to initiate contact between the rotating core and the web;

controlling the position of the winding module and the rotational speed of the mandrel during the winding step to produce a rolled product with desired characteristics; and

10 positioning the winding module to a position in which the step of stripping the rolled product from the winding module takes place.

34. A method of producing a rolled product from a web comprising the steps of:  
conveying the web by a web transport apparatus;  
winding the web into the rolled product by using a plurality of winding modules wherein at least two of the plurality of winding modules wind the web into the rolled  
5 product at any given time by a process selected from the group of center winding, surface winding, and combinations of center and surface winding, the winding modules acting independently of one another wherein if any winding modules are disabled the remaining winding modules can still wind the web to produce the rolled  
product without shutting down the plurality of winding modules; and  
10 transporting the rolled product from the winding module.

35. The method as set forth in claim 34, wherein the winding modules each have a mandrel and further comprising the steps of:

loading a core on the mandrel;  
positioning the winding module to initiate contact between the rotating core  
5 and the web;  
controlling the position of the winding module and the rotational speed of the mandrel during the winding step to produce a rolled product with desired characteristics; and

10 positioning the winding module to a position in which the step of stripping the rolled product from the winding module takes place.

36. The method as set forth in claim 34, further comprising the step of providing a slit web to be wound by the plurality of independent winding modules.

37. A winder for winding a web to produce a rolled product comprising:  
a web transport apparatus for conveying a web; and a plurality of independent winding modules mounted within a frame, each winding module has a positioning apparatus for moving the winding module into engagement with the web, each winding module has a mandrel that is rotated onto which the web is wound to form the rolled product, the winding modules being operationally independent of one another wherein if one winding module is disabled another winding module can operate to produce the rolled product without shutting down the winder, the rotational speed of the mandrel and the distance between the winding module and the web transport apparatus is controlled so as to produce a rolled product with desired characteristics, the winding modules are configured to wind the web by center winding, surface winding, or combinations of center and surface winding.

38. A winder for winding a web to produce a rolled product comprising:  
a web transport apparatus for conveying a web; and a plurality of independent winding modules mounted within a frame, each winding module has a positioning apparatus for moving the winding module into engagement with the web, each winding module has a mandrel that is rotated onto which the web is wound to form the rolled product, the winding modules being operationally independent of one another wherein if any winding modules are disabled the remaining winding modules can still wind the web to produce the rolled product without shutting down the plurality of winding modules, the rotational speed of the mandrel and the distance

10 between the winding module and the web transport apparatus is controlled so as to produce a rolled product with desired characteristics, the winding modules are configured to wind the web by center winding, surface winding, or combinations of center and surface winding.

39. The winder as set forth in claim 38, wherein each winding module has a core loading apparatus for loading a core onto the mandrel, and has a rolled product stripping apparatus for removing the rolled product from the winding module.

40. The winder as set forth in claim 38, wherein the web transport apparatus is a vacuum conveyor.

41. The winder as set forth in claim 38, wherein the web transport apparatus is a vacuum roll.

42. The winder as set forth in claim 38, wherein the mandrels are vacuum supplied for winding the web to form a coreless rolled product.

43. The winder as set forth in claim 38, wherein the winding modules each have a tail sealing apparatus for connecting a tailing end of the web onto the rolled product.

44. The winder as set forth in claim 38, further comprising a core located on each mandrel, the web is wound onto each core and is attached to the core by adhesion.

45. The winder as set forth in claim 38, further comprising a perforated core located on each mandrel, a vacuum is supplied to the mandrel and draws the web onto each perforated core during the start of the winding of the web.



46. The winder as set forth in claim 38, wherein the plurality of independent winding modules are located in a substantially linear arrangement with respect to one another within the frame.

47. The winder as set forth in claim 38, wherein the plurality of independent winding modules are located in a substantially radial arrangement with respect to one another within the frame.

48. The winder as set forth in claim 38, wherein at least one of the plurality of independent winding modules is located in a different plane.

49. The winder as set forth in claim 38, wherein the web transport apparatus is an electrostatic belt.

50. The winder as set forth in claim 38, further comprising at least one air blast for urging redirecting the web onto the mandrel.

51. The winder as set forth in claim 38, further comprising a waste removal apparatus for removing lengths or pieces of the web.

52. The winder as set forth in claim 38, wherein the winding is affected by controlling tension on the web.

53. The winder as set forth in claim 38, wherein the winding torque is regulated by controlling the speed differential between surface and center drives.

54. The winder as set forth in claim 38, wherein the plurality of independent winding modules are positioned at the end of a tissue machine.

55. The winder as set forth in claim 38, wherein the plurality of independent winding modules wind the web directly from a paper making machine.

56. The winder as set forth in claim 38, wherein the plurality of independent winding modules are configured for producing the rolled product having different sheet counts.

57. The winder as set forth in claim 38, wherein the plurality of independent winding modules are configured for winding a slit web.

58. The winder as set forth in claim 39, wherein the stripping apparatus supports the mandrel to stabilize and properly position the mandrel during core loading and product stripping functions.

59. A winder for winding a web to produce a rolled product comprising:  
a web transport apparatus for conveying a web; and  
a plurality of independent winding modules that are independently driven to independently engage the web as it is conveyed by the web transport apparatus, the winding modules configured to engage the web and wind the web to form a rolled product, each winding module having a center winding means, a surface winding means, and a combination center and surface winding means, the winding modules being structurally and operationally independent of one another wherein if one winding module is disabled another winding module can still operate to produce the rolled product without shutting down the winder.

60. A winder for winding a web to produce a rolled product comprising:

a web transport apparatus for conveying a web; and a single winding module that is positioned to engage the web as the web is conveyed by the web transport apparatus, the winding module is configured to engage the web and wind the web to form a rolled product by center winding, surface winding, or combinations of center and surface winding.